QP Code: S253A025 Reg. No | | | | | | | | | | | AY 23

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Third Semester – Regular & Supplementary) Examinations, November 2025

23BCVPC23002-Mechanics of Materials

(CIVIL)

Time: 3 hrs Maximum: 60 Marks

(The figures in the right hand margin indicate marks)

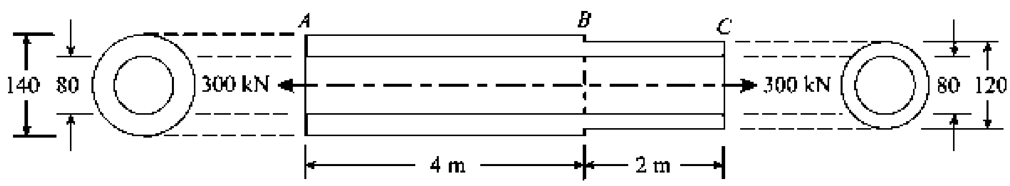
PART – A **(2 x 5 = 10 Marks)**

Q.1. Answer ***ALL*** questions	CO #	Blooms Level
a. Compare roller support and fixed support.	CO2	K2
b. Define stress and strain.	CO1	K2
c. Write the expression of torsion.	CO5	K2
d. Define Poisson's Ratio.	CO3	K2
e. Define hoop's stress.	CO5	K2

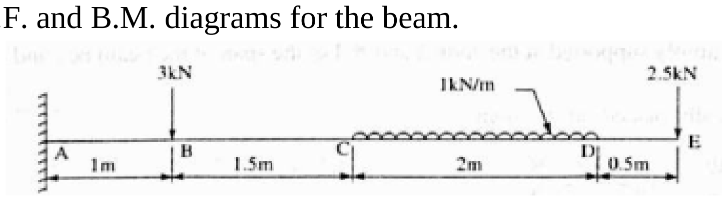
PART – B **(10 x 5 = 50 Marks)**

<u>Answer ***ALL*** the questions</u>

		Marks	CO #	Blooms Level
2. a.	A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5cm and internal diameter of 4cm. the composite bar is then subjected to an axial pull of 45000N.if the length of each bar is equal to 15 cm, determine: i. The stresses in the rod and tube ii. Load carried by each bar	10	CO1	K3
	(OR)			
b.	A 6 m long hollow bar of circular section has 140 mm diameter for a length of 4m, while it has 120 mm diameter for a length of 2 m. The bore diameter is 80mm throughout as shown in Figure. Determine the elongation of the bar, when it is subjected to an axial tensile force of 300 KN. Take modulus of elasticity for the bar material as 200 GPa.	5	CO1	K3

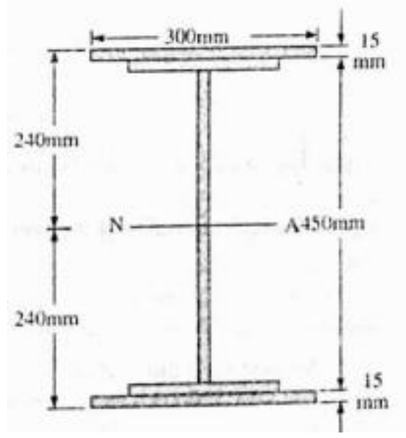


		Marks	CO #	Blooms Level
c.	An alloy bar 2 m long is held between two supports. Find the stresses developed in the bar, when it is heated through 30 K if both the ends (i) do not yield (ii) yield by 1 mm. Take the value of E and α for the alloy as 120 GPa and 24×10^{-6}/K	5	CO1	K3
3.a.	Draw the S.F. and B.M. diagrams for the beam.	10	CO2	K3



(OR)

		Marks	CO #	Blooms Level
b.	A beam AB 10m long is simply supported at its ends A and B. It carries a uniformly distributed load of 20 kN/m for a distance of 5m from the left end A and a concentrated load of 40 kN at a distance of 2m from the right end B. Draw the S.F and B.M. diagrams for the beam.	10	CO2	K3

4.a.	A rolled steel joist of 4.5 m span is simply supported at both ends. The c/s is shown in the figure. Determine i. Moment of inertia of the enlarged section ii. The greatest central point load the beam will carry if the bending stress is not to exceed 125 MPa.  	10	CO3	K3
	(OR)			
b.	A 12 cm by 5 cm I-beam is subjected to a shearing force of 10 KN. Determine the value of the transverse shear stress at the neutral axis and at the top of the web. Moment of inertia = 220 cm^4; area = 9.4 cm^2; web thickness = 0·35 cm; flange thickness = 0·55 cm.	5	CO3	K3
c.	A I- beam of top flange = (*50 mm × 20 mm*), web = (*70 mm × 15 mm*) and bottom flange = (*25 mm × 10 mm)* is made of material with permissible stress in tension equal to 140 MPa respectively. Determine the moment of resistance of the cross-section, when subjected to a moment causing tension at the bottom.	5	CO3	K3
5.a.	The principal stresses at a point in the section of a member are 50 MPa and 20 MPa both tensile. If there is a clockwise shear stress of 30 MPa, determine analytically: i. The normal stress, shear stresses on a section inclined at an angle of 15° with the major tensile stress. ii. The maximum and minimum principal stress and maximum shear stresses.	10	CO4	K3
	(OR)			
b.	The strain measured using 60° strain rosette as shown in figure are $\varepsilon_p = 500 \times 10^{-6}$, $\varepsilon_q = 250 \times 10^{-6}$ and $\varepsilon_r = 150 \times 10^{-6}$. Determine: i. $\varepsilon_x, \varepsilon_y$ & γ_{xy}. ii. Principal strains and maximum shear strain iii. Principal stresses. (Take E= 200 GPa and $\vartheta = 0.3$.)	10	CO4	K3
6.a.	The design of a machine element needs a 40 mm diameter solid shaft to deliver 50 kW at 720 rpm. Determine the maximum shear stress for the shaft. If the speed of rotation in increased to 1080 rpm to deliver the same power, determine the largest inner diameter of a hollow shaft of 40 mm outer diameter for a maximum shear stress same as that of the solid shaft.	5	CO5	K3
b.	An aluminium tube of outer diameter 40 mm and inner diameter 30 mm is 460 mm long. When the tube is subjected to a torque of 650 Nm, the angle of twist is found to be 3.5°. Determine the maximum shear stress, the modulus of rigidity and the maximum shear strain.	5	CO5	K3
	(OR)			
c.	A cylindrical shell of 1.3 m diameter is made up of 18 mm thick plates. Find the circumferential and longitudinal stress in the plates, if the boiler is subjected to an internal pressure of 2.4 MPa. Take efficiency of the joints as 70%.	5	CO5	K3
d.	A bar *30mm × 30mm × 250mm* long is subjected to a pull of *90 kN* in the direction of its length. The extension of the bar was found to be *0.125 mm,* while in each lateral dimension is found to be *0.00375mm*. Determine the Young's modulus, Poisson's ratio, Shear modulus and Bulk modulus for the material of the bar.	5	CO5	K3

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